

PATENT COOPERATION TREATY

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From the INTERNATIONAL SEARCHING AUTHORITY

COPY PCT

To:
TIMOTHY W. HAGAN
DINMORE & SHOHL, LLP
ONE SOUTH MAIN STREET, SUITE 1300
ONE DAYTON CENTRE
DAYTON, OH 45402-2023

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

AMP

JUN 13 2007

DOCKETED

Date of Mailing
(day/month/year) **08 JUN 2007**

Applicant's or agent's file reference
BAT0099PB

FOR FURTHER ACTION See paragraphs 1 and 4 below

International application No.
PCT/US05/01402

International filing date
(day/month/year)
18 January 2005 (18.01.2005)

Applicant
BATTELLE MEMORIAL INSTITUTE

1. ☒ The applicant is hereby notified that the international search report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

Where? Directly to the International Bureau of WIPO, 34, chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 338.82.70.

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90 *bis*.1 and 90 *bis*.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/ US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
Facsimile No. (571) 273-3201

Authorized officer

William Krynski
DEBORAH A. THOMAS
PARALEGAL SPECIALIST
Telephone No. 571-272-1700

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference BAT0099PB | FOR FURTHER ACTION <div style="display: flex; justify-content: space-between; font-size: small;"> see Form PCT/ISA/220 as well as, where applicable, item 5 below. </div> | |
| International application No. PCT/US05/01402 | International filing date (<i>day/month/year</i>) 18 January 2005 (18.01.2005) | (Earliest) Priority Date (<i>day/month/year</i>) 16 January 2004 (16.01.2004) |
| Applicant BATTELLE MEMORIAL INSTITUTE | | |

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report

a. With regard to the **language**, the international search was carried out on the basis of:



the international application in the language in which it was filed.



a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☒ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (See Box No. III)

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. _____



as suggested by the applicant.



as selected by this Authority, because the applicant failed to suggest a figure.



as selected by this Authority, because this figure better characterizes the invention.

b. ☒

none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/01402

A. CLASSIFICATION OF SUBJECT MATTER

IPC: C25B 9/00(2006.01);C25B 1/00(2006.01)

USPC: 204/269,275.1;205/543,548

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 204/269,275.1; 205/543,548

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------------------|
| Y | WO 01/21856 A1 (LICHT) 29 March 2001 (29.03.2001), whole document. | 36-39 |
| X | US 6,080,288 A (Schwartz et al.) 27 June 2000 (27.06.2000), abstract, column 3, line 66 to column 5, line 67. | 1-4; 6-7; 9-22 |
| --- | | ----- |
| Y | | 5; 8; 23-40; 42; 45; 63-66; 73-86 |
| Y | US 2003/0042134 A1 (TREMBLAY et al.) 6 March 2003 (06.03.2006), paragraph [0057] | 5 |
| Y | US 4,243,494 A (RIGGS, Jr. et al.) 6 January 1981 (06.01.1981), Figure, column 2, lines 11-48 | 8; 23-40; 42; 46-50; 63-67; 73-86 |
| Y,P | US 6,837,984 B2 (WANG) 4 January 2005 (04.01.2005), Figure 8, column 11, line 23 to column 13, line 34. | 42 |



Further documents are listed in the continuation of Box C.



See patent family annex.

| | | | |
|--|---|-----|--|
| * Special categories of cited documents: | | "T" | later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
| "A" | document defining the general state of the art which is not considered to be of particular relevance | "X" | document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone |
| "E" | earlier application or patent published on or after the international filing date | "Y" | document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| "L" | document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "&" | document member of the same patent family |
| "O" | document referring to an oral disclosure, use, exhibition or other means | | |
| "P" | document published prior to the international filing date but later than the priority date claimed | | |

Date of the actual completion of the international search

09 May 2007 (09.05.2007)

Date of mailing of the international search report

08 JUN 2007

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
Facsimile No. (571) 273-3201

Authorized officer

Roy King

Telephone No. (571)-272-1234

DEBORAH A. THOMAS
PARALEGAL SPECIALIST

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US05/01402

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-------------------|---|---|
| X,E --- Y,E | US 7,045,051 B2 (MINEVSKI et al.) 16 May 2006 (16.05.2006), column 5, line 27 to column 9, line 60. | 43-44; 51-62, 68-72; 87-89 ----- 45-50; 63-67; 73-86 |
| A | BOUZEK, K et al., "Influence of anode material on current yields during ferrate(VI) production by anodic iron dissolution" Journal of Applied Electrochemistry, vol. 26 (1996) pp. 919-923. | 1-89 |

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

| | | | | | |
|---|--|--|---|--|--|
| To: TIMOTHY W. HAGAN DINMORE & SHOHL, LLP ONE SOUTH MAIN STREET, SUITE 1300 ONE DAYTON CENTRE DAYTON, OH 45402-2023 | | | PCT WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1) | | |
| | | | Date of mailing (day/month/year) 08 JUN 2007 | | |
| Applicant's or agent's file reference BAT0099PB | | | FOR FURTHER ACTION See paragraph 2 below | | |
| International application No. PCT/US05/01402 | | International filing date (day/month/year) 18 January 2005 (18.01.2005) | | Priority date (day/month/year) 16 January 2004 (16.01.2004) | |
| International Patent Classification (IPC) or both national classification and IPC IPC: C25B 9/00 (2006.01); C25B 1/00 (2006.01) USPC: 204/269,275.1;205/543,548 | | | | | |
| Applicant BATTELLE MEMORIAL INSTITUTE | | | | | |

1. This opinion contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|--|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the opinion |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input checked="" type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

| | | |
|--|--|---|
| Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201 | Date of completion of this opinion 29 May 2007 (29.05.2007) | Authorized officer <div style="text-align: right;"> DEBORAH A. THOMAS PARALEGAL SPECIALIST </div> Roy King Telephone No. (571)-272-1234 |
|--|--|---|

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US05/01402

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

- ☐ a sequence listing
- ☐ table(s) related to the sequence listing

b. format of material

- ☐ on paper
- ☐ in electronic form

c. time of filing/furnishing

- ☐ contained in the international application as filed.
- ☐ filed together with the international application in electronic form.
- ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US05/01402

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | |
|-------------------------------|---|-----|
| Novelty (N) | Claims <u>5, 8, 23-42, 45-50, 63-67, 73-86</u> | YES |
| | Claims <u>1-4, 6-7, 9-22, 43-44, 51-62, 68-72 and 87-89</u> | NO |
| Inventive step (IS) | Claims <u>NONE</u> | YES |
| | Claims <u>1-89</u> | NO |
| Industrial applicability (IA) | Claims <u>1-89</u> | YES |
| | Claims <u>NONE</u> | NO |

2. Citations and explanations:

Please See Continuation Sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US05/01402

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claims 7 and objected to under PCT Rule 66.2(a)(iii) as containing the following defect(s) in the form or contents thereof: Claim 7 is missing the dependent claim number that it is depending on.

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US05/01402

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 1-4, 6-7 and 9-22 lack novelty under PCT Article 33(2) as being anticipated by Schwartz et al. (US 6,080,288). Schwartz et al. discloses the claimed apparatus with an undivided cell, including multiple electrolyte outlets, claimed anode, claimed cathode, a fluid controller including a screen or a weir and a power supply capable of variable DC (abstract, column 3, line 66 to column 67). It is noted that claims specifying the electrolyte contained in the apparatus are only the working fluid and thus not objected in an apparatus claim as long as the apparatus is capable of containing such an electrolyte.

Claims 43-44, 51-62, 68-72 and 87-89 lack novelty under PCT Article 33(2) as being anticipated by Minevski et al. (US2003/0159942). Minevski et al. discloses a method of making ferrate (VI) with continuous filtering, providing an undivided cell, a screen, the claimed anode and cathode, an electrolyte solution that overlaps the claimed electrolyte(s), the claimed voltage and current conditions and electrolyte recycling (column 5, line 27 to column 9, line 60). It is further noted that overlapped AC onto a DC signal (if the DC signal has a greater value than AC amplitude) would include a minimum voltage being greater than 0. Furthermore, Minevski et al. discloses alternating the voltage to prevent excessive film growth on electrodes and hence substantially overcome passivation at the anode.

Claims 5, 8, 23-42, 45-50, 63-67 and 73-86 meet novelty under PCT Article 33(2).

Claim 5 lacks an inventive step under PCT Article 33(3) as being obvious over Schwartz et al. in view of Tremblay et al. (US 2003/0042134). Schwartz et al. does not specifically disclose an iron anode, however, Tremblay et al. discloses an iron anode (paragraph [0057]). It would have been obvious to one of ordinary skill in the art to modify Schwartz et al.'s apparatus with Tremblay et al.'s anode because Tremblay et al. teaches an iron anode is conductive (paragraph [00057]).

Claims 8, 23-35 and 40 lack an inventive step under PCT Article 33(3) as being obvious over Schwartz et al. in view of Riggs, Jr. (US 4,243,494). Schwartz et al. does not specifically disclose the claimed anode to cathode area ratio. Riggs, Jr. discloses the claimed anode to cathode area ratio (Figure, column 2, lines 11-48). It would have been obvious to one of ordinary skill in the art to modify Schwartz et al.'s apparatus in view of Riggs, Jr.'s area ratio in order to obviate the need for a membrane (Riggs, Jr., column 2, lines 11-38). Furthermore, in regards to providing more electrolyte flow past anode than the cathode, it is noted that the anode is substantially larger and thus more electrolyte flows past the anode and would overlap the claimed flow ratios.

Claims 36-39 lack an inventive step under PCT Article 33(3) as being obvious over the prior art as applied in the immediately preceding paragraph and further in view of WO01/21856. WO01/21856 discloses the electrolyte concentration that meet the claimed limitations (Table 1). It would have been obvious to one of ordinary skill in the art to modify Schwartz et al. in view of Riggs, Jr.'s method with WO'865 in order to produce a high value oxidizer in ferrate(VI) (WO'865, abstract).

Claim 41 lacks an inventive step under PCT Article 33(3) as being obvious over Minevski et al. in view of Schwartz et al.. Minevski et al. discloses the claimed limitations as stated in above paragraphs, but does not specifically disclose two outlets. Schwartz et

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US05/01402

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

al. discloses two outlets (column 3, line 66 to column 5, line 67). It would have been obvious to one of ordinary skill in the art to modify Minevski et al.'s method with Schwartz et al.'s two outlets to provide a conduit to recycle the electrolyte (Schwartz et al., abstract).

Claim 42 lacks an inventive step under PCT Article 33(3) as being obvious over Schwartz et al. in view of Riggs, Jr. as stated above, and further in view of Wang (US 2002/0153246). Wang discloses the claimed variable DC voltage (Figure 8, column 11, line 23 to column 13, line 34). It would have been obvious to one of ordinary skill in the art to modify Schwartz et al. in view of Riggs, Jr.'s method with Wang's applied potential because Wang teaches that power supplies can deliver such potentials (Wang, column 11, lines 23-34).

Claim 45 lacks an inventive step under PCT Article 33(3) as being obvious over Minevski et al. in view of Schwartz et al. Minevski et al. in view of Schwartz et al. is applied to the claims for the same reasons as stated in the above paragraphs.

Claims 46-50 lack an inventive step under PCT Article 33(3) as being obvious over Minevski et al. in view of Riggs, Jr. Minevski et al. in view of Riggs, Jr. is applied to the claims for the same reasons as stated in the above paragraphs.

Claims 63-66 and 73-86 lack an inventive step under PCT Article 33(3) as being obvious over Minevski et al. in view of Schwartz et al. and further in view of Riggs, Jr. Minevski et al. in view of Schwartz et al. and further in view of Riggs, Jr. is applied to the claims for the same reasons as stated in the above paragraphs.

Claims 1-89 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

-----NEW CITATIONS-----

US 2003/0159942 A1 (MINEVSKI et al) 28 August 2003, see entire document

US 2002/0153246 A1 (WANG) 24 October 2002, see entire document